PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-016295

(43)Date of publication of application : 22.01.1999

(51)Int.Cl. G11B 20/14

G11B 7/00

(21)Application number : 09-183097 (71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

(22)Date of filing : 23.06.1997 (72)Inventor : INOUE TAKASHI
KAMEDA KEIICHI

(54) OPTICAL DISK DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical disk device which is capable of fast drawing of a readout synchronization clock after reproduction of an unrecorded region, after the retrieval of a recorded region, and after the detection of the pull-out of synchronization, reproducing data also after the unconverged condition of linear velocity and preventing deadlock from being generated.

SOLUTION: A first signal detecting means A detects the rotation information recorded by track meandering of an optical disk 7 and a PLL(phase locked loop) circuit 4 detects the rotation synchronizing clock. The second signal detecting means B detects reproduced signals from the optical disk 7, and the above reproduced signal and the above rotation synchronizing clock are switched by a switcher 20 to be inputted into the PLL circuit 13. At the time of usual operation, the PLL circuit 13 gives the readout synchronizing clock synchronized with the above reproduced signal as the operation clock of the

second signal detecting means. During the reproduction of unrecorded region and a specified time after the retrieval of the recorded region or the out-of-synchronization detection, the switcher 20 gives the readout synchronizing clock synchronized with the above rotation synchronizing clock as an operation clock.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] In the optical disk unit with which the information used as rotational criteria reproduces data from the predetermined field of the optical disk beforehand recorded by meandering of a guide rail The 1st signal detection

means which reproduces the information used as the criteria of said rotation, and the 1st clock synchronization means which outputs the 1st synchronous clock which synchronized with the output signal of said 1st signal detection means, The 2nd signal detection means which reproduces the data recorded on said optical disk, The change means which changes alternatively the output signal of said 2nd signal detection means, and the output signal of said 1st clock synchronization means, The optical disk unit which is equipped with the 2nd clock synchronization means which outputs the 2nd synchronous clock which synchronized with the output signal of said change means, and uses said 2nd synchronous clock as the clock of said 2nd signal detection means of operation.

[Claim 2] It is the optical disk unit according to claim 1 is equipped with a non-recorded period detection means supervise the level of the output signal of the 2nd signal-detection means, and detect a non-recorded period, inputs the 1st synchronous clock into the 2nd clock-synchronization means while a change means shows that the output of said non-recorded period detection means is reproducing the non-record section, and it made output the 2nd synchronous clock with which the 2nd clock-synchronization means synchronized with the 1st synchronous clock.

[Claim 3] It is the optical disk unit according to claim 1 the predetermined time after the retrieval actuation termination whose change means searches the predetermined field where data were recorded inputs the 1st synchronous clock into the 2nd clock synchronization means, and it was made to output the 2nd synchronous clock with which the 2nd clock synchronization means synchronized with the 1st synchronous clock.

[Claim 4] It is the optical disk unit according to claim 1 have a step-out detection means to detect that the 2nd clock synchronization means has caused the synchronous gap, the predetermined time after detecting that step-out produced [said step-out detection means] the change means inputs the 1st synchronous clock into the 2nd clock synchronization means, and it was made to output the 2nd synchronous clock with which the 2nd clock synchronization means synchronized with the 1st synchronous clock.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the optical disk unit which reproduces data from an optical disk.

[0002]

[Description of the Prior Art] In the recordable optical disk rotated by the constant linear velocity (CLV:Constant Linear Velocity) like a mini disc, the roll control information on the address information and the optical disk on an optical disk in which a location is shown absolutely is beforehand recorded by meandering (wobbling) of a guide rail.

[0003] Record coding of said address information is carried out by the record sign which can take clock synchronization easily at the time of playback, for example, a biphase sign, and the signal which carried out FM modulation of this record sign is recorded on the optical disk by meandering of a guide rail.

[0004] When playing such an optical disk, FM modulating signal by meandering of a guide rail is taken out from an optical disk, FM recovery is carried out, and the address information by which biphase coding was carried out is detected. While extracting a rotation synchronous clock from a biphase sign using a PLL (Phase Locked Loop) circuit, biphase decode is performed and address information is detected.

[0005] The roll control information on an optical disk is the rotation synchronous clock detected from the biphase signal, and it controls the spindle motor made to rotate an optical disk so that the frequency and phase of this rotation synchronous clock become a predetermined value.

[0006] Record data are recorded on the predetermined field on an optical disk in a fixed unit, and are recorded as change of the direction of the magnetic domain which it rotates as change of a reflection factor in a phase-change

optical disk, and rotates the plane of polarization of the reflected light in a magneto-optic disk. Record coding of the record data is carried out for the purpose of raising recording density, making a signal frequency band required for record playback as narrow as possible, and making detection of a synchronous clock easy at the time of playback. The RLL sign (RL:Run Length Limited) which restricted the reversal distance of a sign is used in many cases, and EFM (Eight to Fourteen Modulation), RLL (1 7), RLL (2 7), etc. are used.

[0007] At the time of playback, change of a reflection factor or change of rotatory polarization is taken out as amplitude change of an electrical signal. A PLL circuit detects a synchronous clock from this regenerative signal, and a record sign is decoded.

[0008] In such an optical disk unit, the signal-processing technique called the PRML (Partial Response Maximum Likelihood) method which combined the partial response method and the Viterbi decoding method is used for the improvement in recording density. This uses the partial response identification (PR:Partial Response) (PR identification is called hereafter) which causes an intersymbol interference intentionally for a regenerative signal from an optical disk, and uses the Viterbi decoding which is a maximum-likelihood-decoding method (ML:Maximum Likelihood) for detection of data.

[0009] Even if it records a square wave, the wave of the signal reproduced from an optical disk becomes blunt in order to receive a limit in a transmission frequency bandwidth. If recording density is made high, the wave which should be read at specific time of day will interfere with the wave of other time of day. This is called an intersymbol interference. In the regenerative-signal processing which does not use PR identification, a wave is equalized so that this intersymbol interference may be removed. Although an intersymbol interference is suppressed in order that this identification may emphasize the high-frequency component of a regenerative signal, the high-frequency component of a noise will also be emphasized and the S/N ratio of a regenerative signal is worsened. When recording density is raised, aggravation of the S/N ratio by this waveform equalization causes an error of detection data.

[0010] On the other hand, PR identification performs waveform equalization which causes a known intersymbol interference intentionally. Usually, since a high-frequency component is not emphasized, aggravation of a S/N ratio can be suppressed. If Viterbi decoding is combined with this PR identification, data are detectable, performing a kind of error correction. The regenerative signal can be giving correlation in the direction of time amount by PR identification. For this reason, only a specific state transition appears in the data sequence which sampled the regenerative signal. The limited state transition is compared with the data sequence of the actual regenerative signal containing a noise, and the error of detection data can be reduced by choosing the probable state transition.

[0011] In order to perform Viterbi decoding correctly, it is necessary to make the frequency characteristics of a record reversion system in agreement with predetermined PR identification property. Although PR identification property near [as possible] record reproducing characteristics is chosen, generally he amends frequency characteristics using a waveform equalizer (equalizer), and is trying to become equal to predetermined PR property as much as possible.

[0012] Hereafter, an example of the conventional optical disk unit is explained, referring to a drawing. Drawing 4 is the block diagram showing the configuration of the conventional optical disk unit. In drawing, FM modulating signal currently recorded by meandering of a guide rail is taken out from the output signal of an optical pickup 1 with the wobble signal detecter 2, it restores to the FM modulating signal with FM demodulator 3, and biphase sign Bi_phase is obtained. While the PLL circuit 4 detects rotation synchronous-clock Wobble_clock from this biphase sign Bi_phase, it restores to biphase sign Bi_phase with the biphase demodulator 5, and address signal Address is obtained.

[0013] The spindle servo circuit 6 controls the spindle motor 8 made to rotate an optical disk 7 so that the frequency and phase of rotation synchronous-clock Wobble_clock may become a predetermined value.

[0014] The regenerative-signal detector 9 outputs a regenerative signal for the information currently recorded as amplitude change of an electrical signal. By AGC circuit (Automatic Gain Control) 10, a regenerative signal fixes the

average signal amplitude. With A/D converter 11, the output of AGC circuit 10 is sampled and quantized, and is digitized. Waveform equalization of the digitized regenerative signal is carried out so that it may become equal to PR property predetermined with an equalizer 12. The PLL circuit 13 detects read-out synchronous-clock Read_clock using the output signal of an equalizer 12. Read-out synchronous-clock Read_clock is supplied as a clock of A/D converter 11, an equalizer 12, and the Viterbi decoder 14 of operation. the regenerative signal by which identification was carried out to predetermined PR property -- the Viterbi decoder 14 -- the maximum -- presumption of a **** state transition is performed and it is outputted as record data by which RLL encoding is carried out.

[0015]

[Problem(s) to be Solved by the Invention] In such a conventional optical disk unit, since it is recorded on an optical disk 7 by the fixed amount of data per predetermined field, arrangement of the data on an optical disk 7 does not necessarily become continuous, but the regenerative signal turns into an intermittent signal including the non-signal period when passing through a non-record section. Although this non-signal period is a non-signal as data playback, the disk noise in the condition of not recording, the optical noise of the semiconductor laser used as a playback light, the regenerative-signal detector 9, the amplifier noise in AGC circuit 10, etc. are contained in fact, these noises are answered and the dispatch frequency of the PLL circuit 13 is changed sharply. Although it was going to draw the PLL circuit 13 in the right frequency which synchronized with the regenerative signal when it moved from the non-record section to the recorded field, there was a fault said that the read-out error of recording information increases until drawing-in time amount until it synchronizes correctly becomes long and a synchronization is established, when the dispatch frequency is greatly shaken during the non-recorded period.

[0016] Moreover, in order to reproduce a discontinuous record section, retrieval actuation of a recorded field occurs. Since said CLV is used for the roll control of an optical disk 7, a spindle motor 8 is controlled so that linear velocity becomes a predetermined value after retrieval actuation. Although it

is common to make it wait until linear velocity sets as for read-out of recording information, it is the purpose which shortens the time amount which retrieval takes, and before linear velocity finishes setting, the attempt which reads recording information from from occurs. Clock synchronization needed to be performed to the regenerative signal of a data rate which read-out of a signal is possible if the PLL circuit 13 synchronizes with a regenerative signal even if linear velocity has not set, but is different whenever retrieval actuation produces the PLL circuit 13 in this case, it drew like the non-record section passage back, time amount became long, and there was a fault said that there is not sufficient effectiveness for the purpose referred to as shortening retrieval time.

[0017] Furthermore, since read-out synchronous-clock Read_clock is detected using the output signal of an equalizer 12, when waveform equalization near predetermined PR property cannot be performed, an exact read-out synchronous clock cannot be detected. An equalizer 12 will also shift the identification property of an equalizer 12 according to a data rate, if the frequency of read-out synchronous-clock Read_clock changes as a clock of operation. This meant that a predetermined identification property was not acquired, when the read-out synchronous clock according to the data rate of a regenerative signal was not obtained, and there was a fault referred to as that the loop formation which consists of an equalizer 12 and a PLL circuit 13 will carry out a deadlock.

[0018] This deadlock phenomenon was a fault produced also when a power-source noise, a diving noise, etc. of equipment become disturbance and the frequency of read-out synchronous-clock Read_clock shifts not only at the time of non-record section passage and retrieval actuation termination but at the time of the usual signal regeneration.

[0019] While this invention solves the above-mentioned technical problem and shortening the drawing-in time amount of the PLL circuit 13 after non-record section passage and retrieval actuation, an equalizer 12 and the PLL circuit 13 aim at offering the optical disk unit which was made not to carry out a deadlock.

[0020]

[Means for Solving the Problem] The 1st signal detection means which reproduces the information which serves as criteria of the rotation beforehand recorded by meandering of the guide rail in an optical disk in order that this invention may attain the above-mentioned purpose, The 1st clock synchronization means which obtains the 1st synchronous clock which synchronized with the output signal of said 1st signal detection means, The 2nd signal detection means which outputs a regenerative signal from the data recorded on said optical disk, The 2nd clock synchronization means which outputs the 2nd synchronous clock which synchronized with the output signal of said 2nd signal detection means, The change means which changes alternatively the output of said 2nd signal detection means, and the output signal of said 1st clock synchronization means, While having the 2nd clock synchronization means which obtains the 2nd synchronous clock which synchronized with the output signal of said change means and using said 2nd synchronous clock as the clock of said 2nd signal detection means of operation The inside of the predetermined time at the time of record section retrieval termination or step-out [of said 2nd clock synchronization means] during a non-signal period is the optical disk unit it was made to output the 2nd synchronous clock to which said 2nd clock synchronization means synchronized with said 1st synchronous clock with said change means.

[0021] According to this invention, the 1st synchronous clock is a rotation synchronous clock of an optical disk. The 2nd synchronous clock is a read-out synchronous clock which synchronized with the regenerative signal. Moreover, the inside of the predetermined time at the time of record section retrieval or step-out [of said 2nd clock synchronization means] during a non-signal period In order to operate the read-out synchronous clock which synchronized with the rotation synchronous clock the 2nd signal detection means which is the playback means of data as a clock of operation, While operating without [even if it is during a non-signal period, without a clock of operation breaks off, and] shifting from the read-out synchronous clock of a regenerative signal greatly and shortening sharply the drawing-in time amount after non-signal period termination While it operates with a rotation synchronous clock between predetermined time and read-out of data of it becomes possible from

before linear-velocity convergence and synchronous convergence at the time of record section retrieval termination or step-out Since it is not greatly shifted from the read-out synchronous clock of a regenerative signal, the drawing-in time amount after linear-velocity convergence and synchronous convergence is shortened sharply, and the deadlock of the 2nd signal detection means and the 2nd clock synchronization means can be prevented.

[0022]

[Embodiment of the Invention] From the information used as the criteria of the rotation beforehand recorded by meandering of the guide rail of an optical disk, this invention detects the rotation synchronous clock which synchronized with this, changes a regenerative signal and a rotation synchronous clock alternatively, and inputs them into the PLL circuit which obtains the synchronous clock of a regenerative signal.

[0023] The change of a regenerative signal and a rotation synchronous clock supervises the signal level of a regenerative signal, and detects a non-recorded period, and a non-recorded period is constituted so that a rotation synchronous clock may be chosen. Furthermore, the predetermined time after the retrieval actuation termination whose change of a regenerative signal and a rotation synchronous clock searches the predetermined field where data were recorded is constituted so that a rotation synchronous clock may be chosen.

[0024] Furthermore, the change of a regenerative signal and a rotation synchronous clock detects step-out [which obtains the synchronous clock of a regenerative signal / of a PLL circuit], and the predetermined time after step-out detection is constituted so that a rotation synchronous clock may be chosen.

[0025] Hereafter, it explains, referring to a drawing about the gestalt of operation of the optical disk unit of this invention. Drawing 1 is the block diagram showing the configuration of the gestalt of this operation. In addition, the same number is given to the same component as the conventional example shown in drawing 4 , and detailed explanation is omitted. The point that the gestalt of this operation differs from the conventional example is to have the non-signal detecter 15, the step-out detector 16, the OR gate 17, a

timer circuit 18, the OR gate 19, and the change machine 20, change the input to the PLL circuit 13 from regenerative-signal Read_signal of an equalizer 12 to rotation synchronous-clock Wobble_clock corresponding to a non-recorded period, record section retrieval time, and step-out, and try to input.

[0026] It detects that the non-signal detecter 15 is reproducing a non-record section, and non-signal detection flag No_signal is outputted, and the step-out detector 16 detects step-out [of the PLL circuit 13], and outputs step-out detection flag Unlock. Moreover, a timer circuit 18 outputs pulse Timer_out of fixed time amount for step-out detection flag Unlock and retrieval ending flag End_of_access as a trigger. In addition, the OR gate 17 outputs the OR of said step-out detection flag Unlock and retrieval ending flag End_of_access, and the OR gate 19 outputs the OR of non-signal detection flag No_signal and pulse Timer_out.

[0027] The actuation is explained in the above-mentioned configuration. FM modulating signal currently recorded by meandering of a guide rail is taken out from the output signal of an optical pickup 1 with the wobble signal detecter 2 of the 1st signal detection means A, it gets over with FM demodulator 3, and biphase sign Bi_phase is obtained. Rotation synchronous-clock Wobble_clock is detected from biphase sign Bi_phase in the PLL circuit 4, it restores to biphase sign Bi_phase with the biphase demodulator 5, and address signal Address is obtained. The spindle servo circuit 6 controls the spindle motor 8 made to rotate an optical disk 7 so that the frequency and phase of rotation synchronous-clock Wobble_clock may become a predetermined value.

[0028] The regenerative-signal detector 9 outputs a regenerative signal for the information currently recorded as amplitude change of an electrical signal. As for a regenerative signal, the average signal amplitude is fixed by AGC circuit 10. With A/D converter 11, the output of AGC circuit 10 is sampled and quantized, and is digitized. Waveform equalization of the digitized regenerative signal is carried out so that it may become equal to PR property predetermined with an equalizer 12. The 2nd signal detection means B consists of the above-mentioned regenerative-signal detector 9, AGC circuit

10, A/D converter 11, and an equalizer 12. Read-out synchronous-clock Read_clock is detected by the PLL circuit 13 using the output signal of an equalizer 12. This read-out synchronous-clock Read_clock is supplied as a clock of A/D converter 11, an equalizer 12, and the Viterbi decoder 14 of operation. the regenerative signal by which identification was carried out to predetermined PR property -- the Viterbi decoder 14 -- the maximum -- presumption of a **** state transition is performed and it is outputted as record data by which RLL encoding is carried out.

[0029] The non-signal detecter 15 carries out the monitor of the output-signal level of the regenerative-signal detector 9, detects a non-signal state, and outputs non-signal detection flag No_signal. Moreover, the step-out detector 16 carries out the monitor of whether read-out synchronous-clock Read_clock which the PLL circuit 13 detects synchronizes with a regenerative signal, and when not synchronizing, it outputs step-out detection flag Unlock. The synchronizing signal is usually inserted in the data currently recorded on the optical disk 7 at fixed spacing. The unique pattern with which this synchronizing signal does not appear in the transformation rule of a record sign is used. Step-out is detectable if the monitor of the detection situation of a synchronizing signal pattern is carried out.

[0030] Drawing 2 is the block diagram in which changing to the PLL circuit 13 and showing the configuration of a vessel 20. The change machine 20 changes alternatively two input signals, i.e., read-out synchronous-clock Read_clock, and rotation synchronous-clock Wobble_clock according to the change signal Select, and outputs them to the PLL circuit 13. In the PLL circuit 13, it changes to one input of a phase comparator 21, the output signal of a vessel 20 is connected, the output signal of VCO23 by which dividing was carried out to the input of another side with the 1-/N counting-down circuit 22 is connected, and closed-loop actuation is carried out so that the output signal of the 1-/N counting-down circuit 22 may synchronize with the output signal of the change machine 20.

[0031] Drawing 3 is the block diagram showing the configuration of the PLL circuit 4. One input of a phase comparator 24 is biphase sign Bi_phase, and the output signal of VCO26 by which dividing was carried out to 1/M (M is an

integer) with the 1/M counting-down circuit 25 is connected, and the input of another side is carrying out closed-loop actuation so that the output signal of the 1/M counting-down circuit 25 may synchronize with a biphase sign. 1 / L counting-down circuit 27 carries out dividing of the output signal of VCO26 to 1/L (L is an integer), changes it as rotation synchronous-clock Wobble_clock, and is connected to the input of a vessel 20.

[0032] In drawing 1 , if the output signal of the regenerative-signal detector 9 detects that it is a non-signal state and outputs non-signal detection flag No_signal, the non-signal detecter 15 will change via the OR gate 19, and will be inputted into a vessel 20 as a change signal Select. The change machine 20 in drawing 2 changes the signal to choose from regenerative-signal Read_signal outputted from an equalizer 12 to rotation synchronous-clock Wobble_clock. Therefore, rotation synchronous-clock Wobble_clock is inputted into the phase comparator 21 of the PLL circuit 13, and read-out synchronous-clock Read_clock synchronizes with rotation synchronous-clock Wobble_clock. Since rotation synchronous-clock Wobble_clock is the signal taken out from the meandering information on the guide rail of an optical disk 7, as long as a playback condition continues, it does not break off. Therefore, even if a regenerative signal will be in a non-signal state, when making it read-out synchronous-clock Read_clock synchronize with rotation synchronous-clock Wobble_clock, the frequency of read-out synchronous-clock Read_clock can stand by near [where it does not shift greatly and a regenerative signal exists] the frequency.

[0033] Since it changes so that non-signal detection flag No_signal will be canceled if it becomes the record section where a non-signal period expires next and a regenerative signal exists again, and the change machine 20 may input regenerative-signal Read_signal of an equalizer 12 into the PLL circuit 13, the PLL circuit 13 begins to synchronize with regenerative-signal Read_signal again. Drawing-in time amount does not become long that it should perform only phase drawing in since the non-signal state was also standing by without the frequency of read-out synchronous-clock Read_clock shifting greatly synchronizing with rotation synchronous-clock Wobble_clock. Moreover, since the frequency drift of read-out synchronous-clock Read_clock

does not arise, the inside of a non-signal can also hold a predetermined identification property, and, as for the identification property of an equalizer 12, can acquire an accurate identification property from immediately after the restart of a regenerative signal.

[0034] Moreover, retrieval of the record section on an optical disk 7 is performed as follows. It is directed in an optical pickup servo circuit (not shown) that a system controller 28 moves an optical pickup 1 to a target record section. Since the optical disk 7 is rotating by said CLV, linear velocity immediately after an optical pickup 1 moves to a target field is the value from which it separated from the predetermined value. At this time, the spindle servo circuit 6 starts control of a spindle motor 8 so that linear velocity may become a predetermined value based on the meandering information on a guide rail, and migration to a target field outputs retrieval ending flag End_of_access, as for a system controller 28, an optical pickup 1 indicates it to be to have completed. Retrieval ending flag End_of_access is inputted into a timer circuit 18 via the OR gate 17. A timer circuit 18 outputs pulse Timer_out of fixed time amount for retrieval ending flag End_of_access as a trigger.

[0035] Pulse Timer_out is changed via the OR gate 19, and is inputted into a vessel 20 as a change signal Select. In drawing 2 , the change machine 20 changes the signal to choose from regenerative-signal Read_signal to rotation synchronous-clock Wobble_clock. Therefore, if read-out synchronous-clock Read_clock is synchronized with rotation synchronous-clock Wobble_clock even while not being completed as a predetermined value by linear velocity, since read-out synchronous-clock Read_clock of the frequency which synchronized with the data rate of regenerative-signal Read_signal at the time will be obtained, even if the data rate of regenerative-signal Read_signal has shifted from predetermined linear velocity, the identification property of an equalizer 12 turns into a property predetermined [according to a data rate]. If fixed time amount set up in a timer circuit 18 next passes and changes and a vessel 20 changes the input of a phase comparator 21 from rotation synchronous-clock Wobble_clock to read-out synchronous-clock Read_clock, that the PLL circuit 13 should perform only phase drawing in, drawing in is

completed for a short time, and before being completed by linear velocity, read-out of recording information [from] will become possible. Therefore, compaction of the time amount which retrieval takes can be aimed at. moreover, the problem referred to as carrying out a deadlock, without originating in that there is [profit] no identification property predetermined with an equalizer 12, and being able to draw the PLL circuit 13 a ** term is not produced, either.

[0036] Moreover, detection of that read-out synchronous-clock Read_clock which the PLL circuit 13 detects does not synchronize with a regenerative signal with the step-out detector 16 outputs step-out detection flag Unlock. Step-out detection flag Unlock is inputted into a timer circuit 18 via the OR gate 17. A timer circuit 18 outputs pulse Timer_out of fixed time amount for step-out detection flag Unlock as a trigger. Pulse Timer_out is changed via the OR gate 19, it is inputted into a vessel 20 as a change signal Select, and the change machine 20 changes the signal to choose from regenerative-signal Read_signal to rotation synchronous-clock Wobble_clock in drawing 2 . Therefore, even if actuation of the PLL circuit 13 becomes unstable under the effect of the noise used as disturbance and step-out occurs, since it is made for a fixed period which pulse Timer_out sets up to make read-out synchronous-clock Read_clock draw to rotation synchronous-clock Wobble_clock, the PLL circuit 13 does not carry out the deadlock of it to an equalizer 12.

[0037]

[Effect of the Invention] By detecting a non-signal period, when reproducing an intermittent signal, and changing and inputting into a rotation synchronous clock the input of the PLL circuit which detects a read-out synchronous clock in a non-signal period from a regenerative signal, a read-out synchronous clock does not shift greatly during a non-signal period, and this invention can aim at compaction of the drawing-in time amount after non-signal period termination so that clearly from the above explanation.

[0038] Moreover, it can also shorten the drawing-in time amount after retrieval termination while read-out of recording information of between the predetermined time after the retrieval actuation termination which searches

the predetermined field where data were recorded becomes possible from from synchronizing with a rotation synchronous clock and it can aim at compaction of retrieval time, before being completed by linear velocity by changing and inputting the input of a PLL circuit into a rotation synchronous clock from a regenerative signal.

[0039] Furthermore, an equalizer and the deadlock of a PLL circuit can be prevented by a step-out detector's detecting step-out [of a PLL circuit], and the predetermined time after step-out detection changing the input of a PLL circuit to a rotation synchronous clock from a regenerative signal, and inputting.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the configuration of the gestalt of operation of the optical disk unit of this invention

[Drawing 2] The block diagram showing the configuration of the PLL circuit which detects a read-out synchronous clock in the gestalt of this operation, and a change machine

[Drawing 3] The block diagram showing the configuration of the PLL circuit which detects a rotation synchronous clock in the gestalt of this operation

[Drawing 4] The block diagram showing the configuration of the conventional optical disk unit

[Description of Notations]

1 Optical Pickup

2 Wobble Signal Detecter

3 FM Demodulator

4 PLL Circuit (1st Clock Synchronization Means)

5 Biphase Demodulator

6 Spindle Servo Circuit

7 Optical Disk

8 Spindle Motor

9 Regenerative-Signal Detector

10 AGC Circuit

11 A/D Converter

12 Equalizer

13 PLL Circuit (2nd Clock Synchronization Means)

14 Viterbi Decoder

15 Non-Signal Detecter

16 Step-out Detector (Step-out Detection Means)

17 19 OR gate

18 Timer Circuit

20 Change Machine

21 24 Phase comparator

22 1/N Counting-down Circuit

23,26 VCO

25 1/M Counting-down Circuit

27 1 / L Counting-down Circuit

28 System Controller

A The 1st signal detection means

B The 2nd signal detection means

Address Address signal

Bi_phase Biphase sign

End_of_access Retrieval ending flag

No_signal Non-signal detection flag

Read_clock Read-out synchronous clock (the 2nd synchronous clock)

Read_signal Regenerative signal

Select Change signal

Timer_out Pulse

Unlock Step-out detection flag

Wobble_clock Rotation synchronous clock (the 1st synchronous clock)